

Claims

1. An actuator unit having a hollow body (4) and having a piezoelectric actuator (1), in which the hollow body (4) is elastically embodied and prestresses the actuator (1), the hollow body (4) is provided with recesses and has a joint (31) extending parallel to a longitudinal axis (35), a bridge piece (19) is provided between each pair of adjacent recesses (7, 7a, 7b), and the hollow body (4) has a first end (17) and a second end (15), characterized in that, the recesses (7a, 7b) adjacent to the joint (31) are smaller than the rest of the recesses (7).
2. An actuator having a hollow body (4) and having a piezoelectric actuator (1), in which the hollow body (4) is elastically embodied and prestresses the actuator (1), the hollow body (4) is provided with recesses and has a joint (31) extending parallel to a longitudinal axis (35), and a bridge piece (19) is provided between each pair of adjacent recesses (7, 7a, 7b), characterized in that the bridge piece (19.1) between a recess (7a, 7b) adjacent to the joint (31) and a recess (7) adjacent to said recess is wider than the bridge pieces (19.2) between the rest of the recesses (7).
3. The actuator unit according to claim 2, characterized in that the ratio of the width of a bridge piece (19.1) between a recess (7a, 7b) adjacent to the joint (31) to the width of the rest of the bridge pieces (19.2b) has a value between 1.3 and 1.9, but in particular a value of 1.6.
4. The actuator unit according to claim 2, characterized in that the widths of the bridge pieces (19.1, 19.2) are dimensioned as a function of the load and the widths (a , a_1 , a_2) of the bridge pieces (19) differ from one another by a factor of 3.

5. The actuator unit according to one of the preceding claims, characterized in that the recesses (7) are disposed in a number of planes (E_i) and the planes (E_i) extend parallel to one another.
6. The actuator unit according to claim 5, characterized in that there is an odd number (i , where $i = 11, 13, 15$, or 17 , for example) of planes (E_i) in which the recesses (7) are disposed.
7. The actuator unit according to one of the preceding claims, characterized in that a number of recesses (7) are disposed one after the other in a plane (E_2) and the plane (E_2) encloses a right angle with the longitudinal axis (35) of the hollow body (4).
8. The actuator unit according to one of the preceding claims, characterized in that a plane (E_2) contains an even number of recesses (7).
9. The actuator unit according to one of the preceding claims, characterized in that the recesses (7) are embodied as bone-shaped and extend lateral to a longitudinal axis (35) of the hollow body (4).
10. The actuator unit according to claim 9, characterized in that the recesses (7) are comprised of a middle piece (37) and two head pieces (39), the head pieces (39) have at least one first radius (R_1), the middle piece (37) has a second radius (R_2), the recesses (7, 7a, 7b) have a length (L), and the following equations apply to the ratios of the recesses (7) disposed in the inner region of the blank to the recesses (7a, 7b) disposed adjacent to the joint (31):

$$R_1(7a, 7b) = 0.867 \times R_1(7)$$

$$R_2 (7a, 7b) = 1.317 \times R_2 (7)$$

$$L (7a, 7b) = 0.984 \times L (7)$$

width (b) of a halved bridge piece (41) in relation to the joint:

$$b > a/2; \text{ in particular } b = 1.4 \times a/2.$$

11. The actuator unit according to claim 9 or 10, characterized in that the recesses (7a, 7b) adjacent to the joint (31) have the following dimensions:

$$R_1 (7a, 7b) = 0.35 \text{ mm to } 0.43 \text{ mm, in particular } 0.39 \text{ mm}$$

$$R_2 (7a, 7b) = 4.0 \text{ mm to } 8.9 \text{ mm, in particular } 5.0 \text{ mm or } 7.9 \text{ mm}$$

$$L (7a, 7b) = 3.5 \text{ mm to } 4.5 \text{ mm, in particular } 4.0 \text{ mm.}$$

12. The actuator unit according to claim 6 or 7, characterized in that the recesses (7a, 7b) adjacent to the joint (31) have the following dimensions:

$$R_1 (7a, 7b) = 0.41 \text{ mm to } 0.49 \text{ mm, in particular } 0.45 \text{ mm}$$

$$R_2 (7a, 7b) = 5.5 \text{ mm to } 6.5 \text{ mm, in particular } 6.0 \text{ mm}$$

$$L (7a, 7b) = 3.7 \text{ mm to } 4.7 \text{ mm, in particular } 4.2 \text{ mm.}$$

13. The actuator unit according to one of claims 9 to 12, characterized in that the recesses (7) have the following dimensions:

$$R_1 (7) = 0.43 \text{ mm to } 0.51 \text{ mm, in particular } 0.47 \text{ mm}$$

$$R_2 (7) = 4.0 \text{ mm to } 4.8 \text{ mm, in particular } 4.4 \text{ mm}$$

$$L (7) = 4.5 \text{ mm to } 5.5 \text{ mm, in particular } 5.0 \text{ mm.}$$

14. The actuator unit according to one of claims 9 to 13, characterized in that the recesses (7) have the following dimensions:

$R_1(7) = 0.4 \text{ mm to } 0.5 \text{ mm}$, in particular 0.45 mm

$R_2(7) = 5.5 \text{ mm to } 6.5 \text{ mm}$, in particular 6.0 mm

$L(7) = 4.0 \text{ mm to } 4.5 \text{ mm}$, in particular 4.255 mm.

15. The actuator unit according to one of the preceding claims, characterized in that the first radii of the head pieces (39) of a recess (7a, 7b) adjacent to the joint (31) are different from each other.

16. The actuator unit according to one of the preceding claims, characterized in that the recesses (7) of two adjacent planes (E_1) are offset (23) from one another.

17. The actuator unit according to claim 16, characterized in that the offset (23) of the recesses (7) of two adjacent planes is equal to one half the repeat pattern (21) of the recesses (7) of a plane (E_1).

18. The actuator unit according to one of the preceding claims, characterized in that the hollow body (4) has a circular cross section.

19. The actuator unit according to one of the preceding claims, characterized in that the cross section of the hollow body (4) is the shape of a regular polygon.

20. The actuator unit according to one of the preceding claims, characterized in that the hollow body (4) is radially fixed at its first end (17).

21. The actuator unit according to claim 20, characterized in that the first end (17) of the hollow body (4) is radially affixed in the upper cover plate (6) or an adjusting disk (93), in particular by means of an annular groove (39) or a shoulder.

22. The actuator unit according to claim 20, characterized in that the first end (17) of the hollow body (4) is fastened to the upper cover plate (6) by means of welding (41).

23. The actuator unit according to one of the preceding claims, characterized in that the hollow body (4) is radially fixed at its second end (15).

24. The actuator unit according to one of the preceding claims, characterized in that the second end (15) of the hollow body (4) is connected to a lower cover plate (5) or a coupler housing (86).

25. The actuator unit according to claim 24, characterized in that the second end (15) of the hollow body (4) is fastened to the lower cover plate (5) or a coupler housing (86) by means of welding (41).

26. The actuator unit according to one of the preceding claims, characterized in that the first end (17) and/or the second end (15) of the hollow body (4) has a region that is not perforated by recesses (7, 7a, 7b).

27. The actuator unit according to one of the preceding claims, characterized in that the piezoelectric actuator (1) is disposed inside the hollow body (4) and the prestressed hollow body (4) acts on the piezoelectric actuator (1) with compression.

28. The actuator unit according to one of the preceding claims, characterized in that the piezoelectric actuator (1) is disposed outside the hollow body (4) and the prestressed hollow body (4) acts on the piezoelectric actuator (1) with compression.